CLAIMS

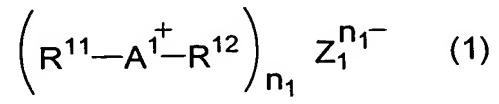
[Claim 1]

A composition for a charge-transport film, comprising at least:

a charge-transporting compound; and

an ionic compound selected from the group consisting of the compounds expressed by the following general formulae (1)-(3),

[Chemical Formula 1]



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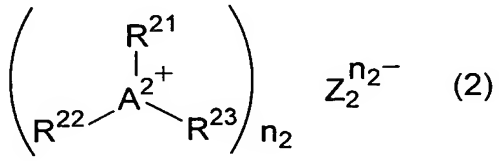

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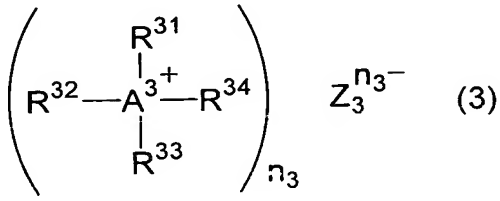


(3)

wherein in general formulae (1)-(3):

R^{11}, R^{21} and R^{31} represent, independently of each other, an organic group bound to A^1-A^3, respectively, via a carbon atom;

R^{12}, R^{22}, R^{23} and R^{32}-R^{34} represent, independently of each other, an arbitrary group; two or more

neighboring groups of R^{11}-R^{34} may combine together to form a ring;

A^1-A^3 each represent an element belonging to the third and subsequent periods in the periodic table;

A^1 represents an element belonging to group 17 of the long form periodic table;

A^2 represents an element belonging to group 16 of the long form periodic table;

A^3 represents an element belonging to group 15 of the long form periodic table;

Z_1^{n1-}-Z_3^{n3-} represent, independently of each other, a counter anion; and

n1-n3 represent, independently of each other, an ionic valency of the counter anion.

[Claim 2]

A composition for a charge-transport film as defined in claim 1, wherein in the general formulae (1)-(3), R^{11}, R^{21}, R^{31} represent, independently of each other, an alkyl group, an alkenyl group, an alkinyl group, an aromatic hydrocarbon group or an aromatic heterocyclic group, which may be substituted.

[Claim 3]

A composition for a charge-transport film as defined in claim 1 or claim 2, wherein in the general formulae (1)-(3), R^{12}, R^{22}, R^{23} and R^{32}-R^{34} represent, independently of each other, an alkyl group, an alkenyl group, an alkinyl group, an aromatic hydrocarbon group or an aromatic heterocyclic group, which may be substituted.

[Claim 4]

A composition for a charge-transport film as defined in any one of claims 1-3, wherein in the general formulae (1)-(3), R^{11}-R^{34} represent, independently of each other, an aromatic hydrocarbon group or an aromatic heterocyclic group, which may be substituted.

[Claim 5]

A composition for a charge-transport film as defined in any one of claims 1-4, wherein in the general formula (1), A^1 is a bromine atom or an iodine atom, and in the general formula (2), A^2 is a selenium atom or a sulfur atom.

[Claim 6]

A composition for a charge-transport film as defined in any one of claims 1-5, wherein in the general formula (1), A^1 is an iodine atom.

[Claim 7]

A composition for a charge-transport film as defined in any one of claims 1-6, wherein in the general formulae (1)-(3), Z_1^{n1-}-Z_3^{n3-} are expressed, independently of each other, by any one of the general formulae (4)-(6),

[Chemical Formula 2]

$$E^1X_4^- \quad (4)$$

$$E^2X_6^- \quad (5)$$

$$Ar^2—E^3(Ar^1)(Ar^3)—Ar^4 \quad (6)$$

wherein in the general formulae (1)-(3):

E^1 and E^3 represent, independently of each other, an element belonging to group 13 of the long form periodic table;

E^2 represents an element belonging to group 15 of the long form periodic table;

X represents a halogen atom; and

Ar^1-Ar^4 represent, independently of each other, an aromatic hydrocarbon group or an aromatic heterocyclic group, which may be substituted.

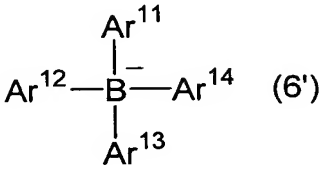
[Claim 8]

A composition for a charge-transport film as defined in claim 7, wherein in the general formulae (4)-(6), Z_1^{n1-}-Z_3^{n3-} are expressed, independently of each other, by the following general formulae (4')-(6'),

[Chemical Formula 3]

$$BX'_4{}^- \quad (4')$$

$$PX'_6{}^- \quad (5')$$



(6')

wherein in the general formulae (4')-(6'):
X' represents a fluorine atom or a chlorine atom;
Ar^{11}-Ar^{14} represent, independently of each other, an aromatic hydrocarbon group which may be substituted or an aromatic heterocyclic group which may be substituted; and
at least one group of Ar^{11}-Ar^{14} has one or plural fluorine atoms or chlorine atoms as substituents.

[Claim 9]

A composition for a charge-transport film as defined in any one of claims 1-8, wherein said charge-transporting compound is an aromatic tertiary amine compound.

[Claim 10]

A composition for a charge-transport film as defined in claim 9, wherein said aromatic tertiary amine compound is a macromolecule compound whose weight-average molecular weight is 1000 or larger and 1000000 or smaller.

[Claim 11]

A composition for a charge-transport film as defined in any one of claims 1-10, further comprising an ether solvent and/or an ester solvent that dissolves said charge-transporting compound and said ionic compound.

[Claim 12]

A composition for a charge-transport film as defined in any one of claims 1-11, wherein said composition is used as a material for a charge-transport layer of an organic electroluminescence device.

[Claim 13]

An organic electroluminescence device, comprising:

a substrate;

an anode and cathode formed on said substrate;

an emitting layer disposed between said anode and said cathode; and

a layer formed between said anode and said emitting layer using a composition for a charge-transport film as defined in any one of claims 1-12.

[Claim 14]

An organic electroluminescence device as defined in claim 13, wherein in said layer formed using said composition for a charge-transport film, the content of said ionic compound is 0.1 weight % or higher and 50 weight % or lower.

[Claim 15]

An organic electroluminescence device as defined in claim 13 or claim 14, further comprising a hole-injection layer and/or a hole-transport layer between said anode and said emitting layer, wherein said hole-injection layer and/or said hole-transport layer is formed using a composition for a charge-transport film as defined in any one of claims 1-12.

[Claim 16]

An organic electroluminescence device as defined in any one of claims 13-15, wherein said

layer using said composition for a charge-transport film is formed by wet coating method.

[Claim 17]

An organic electroluminescence device, comprising:

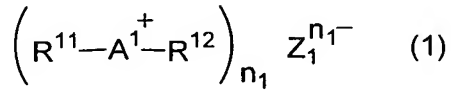
a substrate;

an anode and a cathode formed on said substrate;

an emitting layer disposed between said anode and said cathode;

a layer, disposed between said anode and said cathode, that contains an ionic compound selected from the group consisting of the compounds expressed by the following general formulae (1)-(3),

[Chemical Formula 4]



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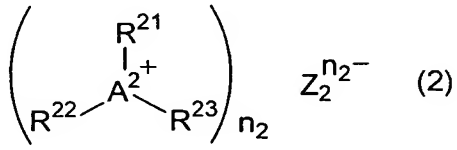

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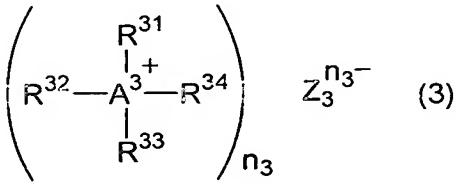


(3)

wherein in general formulae (1)-(3):
R^{11}, R^{21} and R^{31} represent, independently of each other, an organic group bound to A^1-A^3, respectively, via a carbon atom;
R^{12}, R^{22}, R^{23} and R^{32}-R^{34} represent, independently of each other, an arbitrary group; two or more neighboring groups of R^{11}-R^{34} may combine together to form a ring;
A^1-A^3 each represent an element belonging to the third and subsequent periods in the periodic table;
A^1 represents an element belonging to group 17 of the long form periodic table;
A^2 represents an element belonging to group 16 of the long form periodic table;
A^3 represents an element belonging to group 15 of the long form periodic table;
Z_1^{n1-}-Z_3^{n3-} represent, independently of each other, a counter anion; and
n1-n3 represent, independently of each other, an ionic valency of the counter anion.

[Claim 18]

A method of producing an organic electroluminescence device as defined in any one of claims 13-16, comprising the step of drying said composition for a charge-transport film by

heating at a higher temperature than the glass transition temperature of said charge-transporting compound.

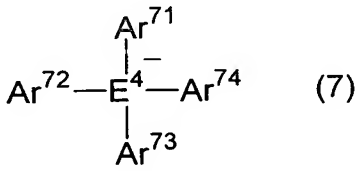
[Claim 19]

A method of producing a charge-transport film by wet coating method using a composition for a charge-transport film as defined in any one of claims 1-12, comprising the step of drying said composition for a charge-transport film by heating at a higher temperature than the glass transition temperature of said charge-transporting compound.

[Claim 20]

An ionic compound composed of a cation radical of a charge-transporting compound and a counter anion, wherein said counter anion is expressed by the following general formula (7)

[Chemical Formula 5]



(7)

wherein in the general formula (7):

E^4 represents an element belonging to group 13 of the long form periodic table; and

Ar^{71}-Ar^{74} represent, independently of each other, an aromatic hydrocarbon group that may have

substituents or an aromatic heterocyclic group that may have substituents.

[Claim 21]

An ionic compound as defined in claim 20, wherein said cation radical of a charge-transporting compound is an aminium cation radical.

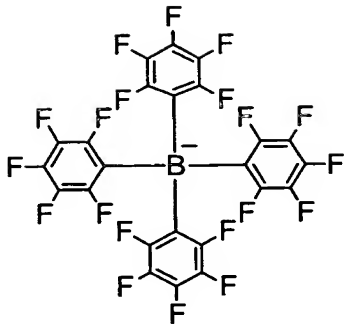
[Claim 22]

An ionic compound as defined in claim 20 or claim 21, wherein in the general formula (7), E^4 is a boron atom or a gallium atom, and at least one of Ar^{71}-Ar^{74} is a group that has one or plural electron-accepting substituents or nitrogen-containing aromatic heterocyclic groups.

[Claim 23]

An ionic compound as defined in any one of claims 20-22, wherein said counter anion is expressed by the following formula (8) or formula (9)

[Chemical Formula 6]



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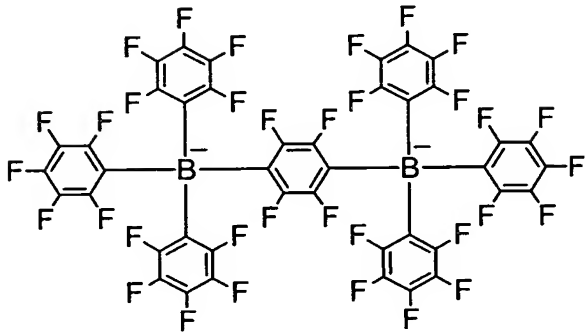
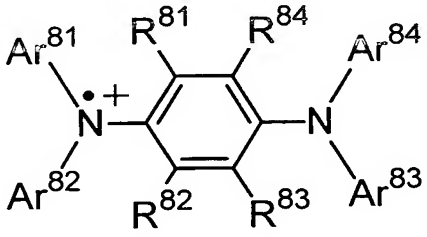


(9)

[Claim 24]

An ionic compound as defined in any one of claims 20-23, wherein said cation radical of the charge-transporting compound is expressed by the following general formula (10),

[Chemical Formula 7]



(10)

wherein in the general formula (10):

Ar^{81}-Ar^{84} represent, independently of each other, an aromatic hydrocarbon group that may have

substituents or an aromatic heterocyclic group that may have substituents; and

R^{81}-R^{84} represent, independently of each other, an arbitrary group.

[Claim 25]

An ionic compound as defined in any one of claims 20-24, wherein said cation radical of the charge-transporting compound has a structure obtained by removing an electron from a repetitive unit of an aromatic tertiary amine macromolecule compound whose weight-average molecular weight is 1000 or larger and 1000000 or smaller.

[Claim 26]

An ionic compound as defined in any one of claims 20-24, wherein said compound is used as an ingredient of a charge-transport film.

[Claim 27]

A composition for a charge-transport film, comprising an ionic compound as defined in any one of claims 20-26.

[Claim 28]

A composition for a charge-transport film as defined in claim 27, wherein said composition is

used as a material for a charge-transport layer of an organic electroluminescence device.

[Claim 29]

A charge transport film, comprising an ionic compound as defined in any one of claims 20-26.

[Claim 30]

An organic electroluminescence device, comprising:

a substrate;

an anode and a cathode formed on said substrate;

an emitting layer disposed between said anode and said cathode; and

a layer disposed between said anode and said cathode, said layer containing an ionic compound as defined in any one of claims 20-26.

[Claim 31]

An organic electroluminescence device, comprising:

a substrate;

an anode and a cathode formed on said substrate;

an emitting layer disposed between said anode and said cathode; and

a layer disposed between said anode and said cathode, said layer being formed by wet application method using a composition for a charge-transport film as defined in claim 27 or claim 28.

[Claim 32]

An electron-accepting compound to be contained in a charge-transport film together with a charge-transporting compound, wherein a resistivity RR_1 [Ωcm] of a charge-transport film 1, which is composed of said electron-accepting compound and a charge-transporting compound, and resistivity RR_0 [Ωcm] of a charge-transport film 2, which is composed of a charge-transporting compound, meet the following relation

$$RR_1/RR_0 < 8\times10^{-2}$$

on the conditions:
that a same compound is used as the charge-transporting compounds contained in the charge-transport film 1 and the charge-transport film 2; and
that the resistivity is the value of {field intensity [V/cm]/current density [A/cm^2]} where the {field intensity [V/cm]/current density [A/cm^2]} is obtained from a field intensity to be applied when a charge-transport film having a film

thickness of between 100-200 nm and a current-carrying area of 0.04 cm^2 carries an electric current corresponding to a current density of between 4-6 mA/cm^2 while being sandwiched between an anode and a cathode.

[Claim 33]

A composition for a charge-transport film, comprising:

a charge-transporting compound; and

an electron-accepting compound as defined in claim 32.

[Claim 34]

A charge transport film, comprising:

a charge-transporting compound; and

an electron-accepting compound as defined in claim 32.

[Claim 35]

An organic electroluminescence device, comprising a charge-transport film as defined in claim 34.